FORM-PTO-1390 (Rev. 10-96)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		040060-108
		U S APPLICATION NO (if known, see 37 C.F.R 1.5) Unassigned **09/581759**

INTERNATIONAL APPLICATION NO. PCT/SE98/02219	INTERNATIONAL FILING DATE December 4, 1998	PRIORITY DATE CLAIMED December 19, 1997

TITLE OF INVENTION
A METHOD AND A DEVICE FOR DELAY REDUCTION IN A COMMUNICATION NETWORK
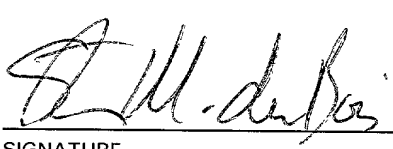
APPLICANT(S) FOR DO/EO/US
Peter LARSEN

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. [X] This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and the PCT Articles 22 and 39(1).

4. [X] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))

    a. [X] is transmitted herewith (required only if not transmitted by the International Bureau).

    b. [X] has been transmitted by the International Bureau.

    c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US)

6. [ ] A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. [X] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))

    a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).

    b. [ ] have been transmitted by the International Bureau.

    c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.

    d. [X] have not been made and will not be made.

8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. [X] A FIRST preliminary amendment.

    [ ] A SECOND or SUBSEQUENT preliminary amendment.

14. [ ] A substitute specification.

15. [ ] A change of power of attorney and/or address letter.

16. [X] Other items or information:

    Unexecuted Declaration; International Preliminary Examination Report

U.S. APPLICATION NO (If known, see 37 CFR 1.50) Unassigned 09/581759	INTERNATIONAL APPLICATION NO PCT/SE98/02219	ATTORNEY'S DOCKET NUMBER 040060-108

17. [X] The following fees are submitted:	CALCULATIONS	PTO USE ONLY

Basic National Fee (37 CFR 1.492(a)(1)-(5)):

Search Report has been prepared by the EPO or JPO $840.00 (970)

International preliminary examination fee paid to USPTO (37 CFR 1.482) $670.00 (956)
No international preliminary examination fee paid to USPTO (37 CFR 1.482)
but international search fee paid to USPTO (37 CFR 1.445(a)(2)) $690.00 (958)

Neither international preliminary examination fee (37 CFR 1.482) nor
international search fee (37 CFR 1.445(a)(2)) paid to USPTO $970.00 (960)

International preliminary examination fee paid to USPTO (37 CFR 1.482)
and all claims satisfied provisions of PCT Article 33(2)-(4) $96.00 (962)

ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 970.00	

Surcharge of $130.00 (154) for furnishing the oath or declaration later than   20 [ ] 30 [ ] months from the earliest claimed priority date (37 CFR 1.492(e)).

$ ---	

Claims	Number Filed	Number Extra	Rate		
Total Claims	10 -20 =	-0-	X$18.00 (966)	$ -0-	
Independent Claims	3 -3 =	-0-	X$78.00 (964)	$ -0-	
Multiple dependent claim(s) (if applicable)			+ $260.00 (968)	$ ---	
		TOTAL OF ABOVE CALCULATIONS =		$ 970.00	

Reduction for 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).

$ ---	-

SUBTOTAL =	$ 970.00	

Processing fee of $130.00 (156) for furnishing the English translation later than   20 [ ] 30 [ ] months from the earliest claimed priority date (37 CFR 1.492(f)).   +

$ ---	

TOTAL NATIONAL FEE =	$ 970.00	

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 (581) per property +

$ ---	

TOTAL FEES ENCLOSED =	$ 970.00	

	Amount to be: refunded	$
	charged	$

a. [X]   A check in the amount of $___970.00___ to cover the above fees is enclosed.

b. [ ]   Please charge my Deposit Account No. 02-4800 in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X]   The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4800. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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35,023
REGISTRATION NUMBER

(09/99)

Patent
Attorney's Docket No. <u>040060-108</u>

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of)	
)	
Peter LARSEN)	Group Art Unit: Unassigned
)	
Application No.: Unassigned)	Examiner: Unassigned
)	
Filed: June 16, 2000)	
)	
For: A METHOD AND A DEVICE FOR)	
DELAY REDUCTION IN A)	
COMMUNICATION NETWORK)	

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE CLAIMS

Please amend claim 3 as follows:

Claim 3,   line 2, delete "or 2".

REMARKS

The above amendment to claim 3 has been made in order to eliminate a multiple

dependency. For the convenience of the Examiner the following items are submitted with

this application:

A) International PCT Publication
B) International Preliminary Examination Report

Favorable action on the merits of the application is respectfully requested.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: _____

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Date: June 16, 2000

A METHOD AND A DEVICE FOR DELAY REDUCTION IN A COMMUNICATION NETWORK

TECHNICAL FIELD

5   The present invention relates to reduction of a total delay of the traffic in a communication network carrying ATM traffic, wherein a multitude of users share a common physical medium. The reduction is particularly advantageous and useful in the use of so called CBR traffic (Constant Bit Rate) which has a low
10   tolerance for delay in the network.

PRIOR ART

In transmission of speech via the telephone network it is important to limit the total delay from transmitter to receiver (round trip delay). If the delay exceeds about 50 ms in for
15   example a telephone connection an eco canceller is required since the delay then becomes annoying to the persons speaking because about this point the persons start to speak at the same time. When these 50 ms in different standards and specifications were allocated to different local, transit and international,
20   stations the access network was constituted by a twin cable having no delay. This results in that nowadays when transmission systems, switching and ATM (Asynchronous Transfer Mode) are introduced also in the access network there is no time from the "delay budget" to allocate. This results in tough requirements
25   regarding a low total delay in the access network.

The reason for the delay in traditional local networks can also be expressed by observing the fact that transport of large data packages and use of a store-and-forward technique in routers and bridges takes time. First there is a delay when the user
30   accumulates data for filling a whole data package. The same delay effect is repeated every time the package is received by a bridge or a router which has to await the entire package before

it can be transmitted onwards to the next link. The delays vary when the package waits in a queue at links, having a heavy load. If all packages are given the same priority there is no possibility for a time critical package to go past the queue.

Regarding the queue problem, ATM has a priority function which makes it possible for time critical traffic to go past a queue.

Also, a terminal can demand that a certain bandwidth is allocated for a particular channel, which guarantees a required capacity. The system relies on that the traffic is classified as either Constant Bit Rate (CBR) Variable Bit Rate (VBR) or Available Bit Rate (ABR). A terminal which intends to transmit a video or audio sequence via CBR or VBR must reserve the required bandwidth when the connection is set up.

If all traffic has the same priority the problem will of course remain. The problem will be particularly big when a narrow band CBR signal (speech) packed in ATM cells is to be transmitted and when the physical layer only offers a fixed low transmission rate. This is often the case in the uplink direction (the traffic from the users or/and equipment towards a common node, for example a local exchange station or a so called "head end") when PON (Passive Optical Network) and COAX system based on TDM (Time Division Multiplex) are used for transmitting ATM traffic. If the delay also varies over time, this will further add to the total delay at the receiver. The more the delay varies the larger a CDV buffer (Call Delay Variation) will be required.

For example, when a single bus is used by a multitude of nodes for transmitting cells in the uplink direction (from user nodes towards a common node) in a TDM based network, the physical medium, in this case the bus, is a common resource which must be used in the best possible manner. Since only one user at the time can transmit on the bus the cell in the user nodes must

wait for "their turn" before they can be transmitted over the physical medium.

This problem arises within a number of application areas where a
5   multitude of users are to share a time multiplex common physical
medium. Closest at hand is speech (telephone) and transmission
using a low constant bandwidth over an ATM connection. Another
area is cable television. When studying the state of the art it
turns out that most documents are found in the technical field
10   of cable television. However, no document shows how one can
minimize said delay time.

US 5,546,199 discloses a method for generation (synthesis) of a
carriers for the uplink direction in a cable television system
by using a reference frequency in the downlink direction. The
15   object is to provide a low-cost carrier having an exact
frequency. The carrier is then used in the common medium, in
this case a coaxial cable. However, the document does not
disclose how one can reduce the total delay in the system. Other
documents found, for example US 4,553,161 describes
20   synchronization of uplink data traffic.

SUMMARY

The invention shall, using a device and a method in a
communication network where a multitude (n) users/nodes share a
common physical medium, reduce the total delay in transmission
25   of data package generated at a fixed rate.

The best or simplest would of course be if the connection had a
bandwidth which was considerably larger than the need and that
there was a function for dynamic bandwidth allocation which
immediately generated transmission permission when a data
30   package/cell is ready in one of the nodes. As a difference to
this ideal case the bandwidth which is to be shared by several
nodes is usually very limited and fully used for payload.

If all traffic has the same priority it will not help to have dynamic allocation of transmission permission. In the case when all nodes simultaneously have a cell ready to transmit the last cell will have to wait a whole period T, where T is the time between two cells from a particular connection (the period) when all other nodes must have a transmission permission each during that time.

According to the invention the problem is solved by a device and a method where the generation of ATM cells is synchronized at the users with the generation of uplink time slots on the common physical medium so that a cell is ready to be transmitted in exactly the same moment when it receives a transmission permission. The condition is that an ATM cell can be fitted in a time slot. Hence, it is required that the generation of ATM cells is synchronized at the user nodes with the allocated time slots in the uplink channel. The synchronization can be implemented in a number of ways but the important thing is that the generated ATM cells arrive at the same rate as the time slots on the common physical medium, so that the data packages can be transmitted directly when they have been packed onto said medium without delay. The random phase which is a result between the time slots and the ATM generation in an initial state can be corrected, for example, using a phase delay device and a phase detector or simply by not using a cell and to start the next cell in the correct phase. It is assumed that TDM is used and that in the normal case each connection make use of a fixed "time slots" for transmission of ATM cells. A frame can be defined as n time slots, one for each connection. A connection uses the "same" time slot in all frames. The period for the frames is constant. It is also possible that the stream of time slots is not defined in frames of the same length but only as a constant flow of time slots. It is however important that the period between two time slots intended for a particular connection is constant.

The advantages which are obtained using this method are clear. The short delay for the packed ATM cells in the user nodes contribute to reduce the total delay in the network.

5   It is assumed that the characteristics of the invention defined in the appended claims are new. However the implementation, function and other advantages are best understood using the description and the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

10   Embodiments of the invention will be described below in conjunction with the accompanying drawings in which:

figure 1   schematically and simplified shows the uplink traffic in a PON/Coax system having a multitude of nodes and a common physical medium according to the state of
15   the art,

figure 2   shows a block diagram in an environment where the invention as described below is useful,

figure 3   shows a block diagram of how a user node is implemented and a method of performing
20   synchronization according to the invention,

figure 4   shows a block diagram of how a user node is implemented and an additional method of performing synchronization according to the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

25   Figure 1 shows the uplink direction for a PON/Coax system having n nodes. The delay in the uplink traffic from n nodes towards a headend according to figure 1 mainly consists of two parts, partly the packing into ATM cells and partly the delay time before the cell can be transmitted.

In order to obtain the correct background and comprehension it can be suitable to use two examples. In the first example dynamic bandwidth allocation is used and in this case some form of MAC function (Medium Access Control) for continuous control and allocation of the available capacity between connections or groups of connections is used. The object is to as soon as possible transmit a cell when it is ready, i.e. to dynamically control the bandwidth allocation. Here we use:

n =   max number of connections

t =   the time to transmit a cell, which depends on the capacity of the connection.

T =   the time between 2 cells from a connection (the period), (64 kb/s voice connection results in T   6 ms).

A condition for the capacity of the connection to be enough for all n connections is thus that nxt T or equivalently that n T/t.

At maximum use of the present bandwidth: $n = T/t$.

The waiting time varies and the maximum waiting time occurs when all connections have a cell to transmit at the same time (= n cells). The last cell then will have the maximum waiting time T. This is however not likely, but the available bandwidth often limits n to such low values that the probability for a waiting time close to T is not negligible.

If we instead have a static bandwidth allocation, which we have in the invention, consecutive transmission permissions are given to each ATM connection at a fixed time interval T1 regardless if there is a cell to transmit or not. The method results in a polling at the frequency $f1$ = $1/T1$ per connection. A sufficiently high capacity for the connection is obtained when T1   T. In order to use the available capacity of the connection

maximally, T1 is to be chosen as large as possible but not larger than T. For 64 kb/s speech T   6 ms. In such a non-synchronized polling method the waiting time has a uniform distribution in the interval 0 - T1.

The conclusion is that the waiting time varies continuously for the two described methods between 0 and 6 ms. The waiting time can however be controlled as a difference from the packing delay which is fixed and not controllable.

When using the proposed method most of the delay is avoided except for the part which is a result from the packing. The total delay for these parts is therefore reduced to about 6 ms. It should however be noted that any additional delay which can result during transmission or in queues are not taken into account.

The description below mainly concerns transmission of 64 kb/s coded speech, but can also be used for other data rates.

Hence, the conditions are that TDM is used and that in the normal case each connection makes of a use of a fixed "time slot" for transmission of ATM cells. A frame is defined as n time slots, one for each connection. A connection uses the "same" time slot in all frames. The period for the frames is constant.

It is also assumed that the uplink and downlink direction on the common medium and the generation of uplink CBR cells (implicitly also the reference frequency for the speech coding, normally 8 kHz) have a common synchronization source.

The waiting time can then be reduced to almost zero if two conditions are fulfilled. Firstly the generation of ATM cells has to be synchronous with the corresponding time slot, i.e. the same number of cells as time slots per time unit. Secondly the ATM cells must be packed and ready for transmission just before

transmission in the allocated time slot. The latter requires that either the time (the phase) when the ATM cell is ready for transmission relative the used time slot can be controlled/ chosen or that a "suitable" free time slot can be allocated to the connection. The latter method should be avoided since it is dependent on other setup connections.

The rate of ATM cells is determined by the AAL being used and by the 8 kHz signal which is normally used for analogue/digital conversion of a speech signal, i.e. that the nominal frequency/ generation of cells is fixed and cannot be controlled. The consequence hereof is that it is the nominal period of time for the allocated time slots that must be adapted to the generation of ATM cells, and not vice versa.

Here we describe speech signals and since such high quality standards are put on them that they must be sent by CBR, it is preferably speech signals which benefit from the invention. It is however not restricted to speech signals, but other types of signals having a constant bit rate can of course be transmitted using the same basic concept of the invention.

When a number of user nodes are to transmit cells towards a common node the term uplink direction is used and when the common node transmits towards the user node the term downlink direction is used. Given that the used time slot in the uplink channel and the ATM cell generation have the same nominal period of time the ATM cell generation can be synchronized to the uplink channel in the following manner: First the frequency is synchronized, i.e. the period of time for the generated ATM cells is adapted/synchronized to the period of time for the allocated time slot, giving a random phase between the time slot and the ATM cell generation. Next, the phase is adjusted so that each generated ATM cell becomes ready/packed just in time before it is to be transmitted in "its" time slot, i.e. just before or

at the same time as the time slot is transmitted so that it can be placed in the time slot.

The method implies that regardless of in which node an ATM cell
5   is generated the phase is adapted to the allocated time slot. The result is that the waiting time can be made arbitrarily short.

Figure 2 shows an example of an environment where the present invention is of great use. The figure shows a HPC (Hybrid-Fiber-
10   Coax) cable television system 1 where a multitude of subscribers/nodes 2-4 share a common physical medium, in this case a bus 5. For reasons of simplicity only three nodes are shown but it is to be understood that the number can be much greater.

15   The cable television network is interactive which means that the subscribers can transmit information in the uplink direction 6. This embodiment gives a good example of the use of the invention and is intended to show a practical implementation. In reality the invention can of course be used in all systems with simplex
20   or duplex communication in a network where a multitude of nodes/subscribers share a common physical medium and where communication with a common unit takes place.

In this example the bus 5 can be a conventional coax cable, but which often in the uplink direction 6 is electrically/optically
25   converted in a converter 7.

The bus 5 is as mentioned connected to a number of subscribers or nodes 2-4. One node 4 has been enlarged and is shown in the figure in more detail and one can here see an example of how the connection can look like. A network terminal 8 is connected as
30   an interface towards the bus 5. The network terminal will be described in more detail below. If this is used as a cable television network, a TV 9 is suitably connected as an external

unit for reception of downlink data 10. In order to transmit data in the uplink direction 6, a circuit emulator 11 can be connected to the network terminal 8 according to the figure. The

5　circuit emulator 11 is then e.g. used for packing the data generated by the subscriber in ATM cells. In order to transmit data in the uplink direction 6 the subscriber can use a computer 12 or an ordinary telephone 13 which then is connected to the node 4. The telephone then of course requires an A/D-conversion

10　29.

The system has an antenna 14 for reception of the TV-signals which then are transmitted to the subscribers. The module 15 illustrates a head-end in a HFC network and provides the telephony function in an interface towards PSTN 16 or the like.

15　The module comprises a MAC (Medium Access Control). In this it is decided which subscriber who is allowed to transmit and when. In the same module 15, modulation of the carrier can also take place. It is common to use a downlink QAM modulation and a QPSK uplink demodulation. The signals from the module 15 and the

20　signals from the antenna 14 can be transmitted on the same medium 19 by means of combining them using a combiner 17.

Figure 3 shows the network terminal 8 and the circuit emulator 11 in more detail. The circuit emulator 11 comprises, besides an ATM cell receiver 20 and a PLL 21 (Phase Locked Loop), also a

25　transmitter 22 where the ATM cells are generated and an A/D converter 29. In this embodiment the A/D converter 29 receives data from a telephone 13 (see figure 2) via the link 18. The emulator 11 is thus connected to the network terminal 8 which in turn has a connection to the bus 5.

30　When one then without imposing a delay adjusts the phase of the generated digital speech signal so that each generated ATM cell is ready for transmission at an optimal time in order for the waiting time in a buffer 23 in the network terminal 8 is to be minimal, the starting point is always information from a phase

detector 26 at the buffer 23 in the network terminal 8. The detector 26 detects the phase between incoming ATM cells from the transmitter 22 and the allocated time slot on the bus 5. In the circuit according to the solution a signal thus arrives which it takes some time for, let us say x ms to pack. A transmission permission with downlink data also arrives each x ms. Thus, the object is to make certain that the generated ATM cell is packed and transmitted to the buffer 23 just before transmission is to take place in the common medium 5, using the phase control of the downlink traffic.

There are many alternative ways to control the phase of the ATM cell generation. The alternative which is illustrated in figure 3 is when the clock in the downlink direction 10 is used as a reference for the uplink traffic 6 as well (here illustrated with the network reference 31). Then the phase in the downlink direction 10 to the circuit emulator 11 can be adjusted using a controllable phase delay unit 24, using the information from the above mentioned phase detector 26 via the connection 28, until the uplink cells obtain a suitable phase (become ready/packed in an optimal time according to above), relative their allocated time slots. This is obtained by means of phase delaying the traffic in the downlink direction in the module 25 in the network terminal 8 so that the PLL 21 in the circuit emulator 11 preferably clocks the A/D converter 29 so that the cells can be packed in the transmitter 22 and that the transmission to the buffer 26 is ready just before the transmission permission arrives for the transmission to the time slot in the common physical medium.

This is called an indirect method since the circuit emulator 11 cannot "see" that the phase changes. It just follows the phase in the donwlink direction. This indirect method can also be used in an embodiment where the uplink ATM cells are generated in a unit integrated in the network terminal 8. In this case there is

no need for a separate PLL 21 but the output signal from the phase delay 24 can be used as a clock signal.

In another embodiment which is illustrated in figure 4, a control channel 30 can be used for controlling the phase from the PLL 21'. Then one must let the phase detector 26' transmit the same phase control information as above via the control channel 30 to, for example, the PLL 21' from cell generation so that the phase to be controlled to a desired position according to the above. This method is called a direct method since in this case necessary information is given directly to the PLL 21' of the circuit emulator.

The methods illustrated above are not limited to the shown preferred embodiment but can of course be used in every case where ATM cells from many sources located at different locations are to be transmitted via a common TDM based physical medium, for example coax, fibre or radio. It should also be noted that the embodiments in figures 3 and 4 only show possible ways to implement the invention as such. The essence of the invention lies in that one provides control of the generation of ATM cells to a respective allocated time slot in order to minimize the waiting time for the cells.

CLAIMS

1. A method of reduction of the delay of ATM traffic in a communication network where a multitude of nodes (2-4) which generate ATM cells use a common time multiplex physical medium (5) for transmission, **characterized in** that the period for the generation of ATM cells in said nodes (2-4) and the time slots of the physical medium are synchronized both with regard to frequency and phase so that the cells in the nodes (2-4) have been packed at the same time as, or just before, transmission in a respective allocated time slot for a particular node.

2. A method of reduction of the delay of ATM traffic according to claim 1, **characterized in** that the synchronization is obtained by synchronizing the period for the generation of ATM cells to the period for the allocated time slots on the uplink channel 6 of the common physical medium, by using the clock in the downlink connection 10 as synchronization source also for the uplink direction.

3. A method of reduction of the delay of ATM traffic according to claim 1 or 2, **characterized in** that the phase when the ATM cells will be ready for transmission relative their respective allocated time slots is identified using a phase detector (26) which senses the phase between incoming ATM cells from a transmitter (22) and the allocated time slot on the bus (5).

4. A method of reduction of the delay of ATM traffic according to claim 3, **characterized in** that a phase delay unit (24) adjusts the phase of the downlink clock so that the ATM cells generated in the transmitter (22) are packed and transmitted to the buffer (23) so that the waiting time there becomes minimal before they are transmitted on the common medium (5).

5. A method of reduction of the delay of ATM traffic according to claim 3, **characterized in** that a control channel (3) from the

14

phase detector (26') transmitting information regarding the
phase between ATM cells arriving to the phase detector (26')
from a transmitter (22) and an allocated time slot on the bus
5   (5), controls a PLL (21') connected to the transmitter (22) so
that the ATM cells generated in the transmitter are packed and
transmitted to the buffer (23) so that the waiting time there
becomes minimal before they are transmitted on to the common
medium (5).

10   6.   A method of reduction of delay of ATM traffic in a
communication network where a multitude of nodes (2-4) which
generate ATM cells use a common time multiplex physical medium
(5) for transmission, **characterized in** that the period for
generation of ATM cells in said nodes (2-4) is given by the
15   clock of the downlink direction (10) of the physical medium (5)
and that the time slots of the physical medium in the uplink
direction (6) is controlled by the same clock, resulting in a
random phase between the generation of a cell and the allocated
time slots thereof in the uplink direction and that this phase
20   is adjusted so that each generated ATM cell will be packed at
the same time as, or just before it is to be transmitted in the
time slot allocated for this particular connection.

7. A device for reduction of the delay of ATM traffic in a
communication network comprising a multitude of nodes (2-4) and
25   a common time multiplex physical medium (5) connected to these,
on which medium (5) uplink (6) and downlink (10) traffic is
transmitted and the uplink traffic (6) is generated in said
nodes (2-4), **characterized in** that the nodes (2-4) comprise at
least one network terminal (8) connected to said common physical
30   medium (5) and at least one module (for example a circuit
emulator (11)) where the generation of ATM cells is carried out,
wherein the generation is controlled so that the ATM cells are
packed and ready to be transmitted at the same time as or just

before transmission in a time slot on the common physical medium
(5) allocated for this purpose.

8. A device for reduction of delay of ATM traffic in a
communication network comprising a multitude of nodes (2-4),
according to claim 7, **characterized in** that the nodes comprise
means for controlling the phase of when the ATM cell is to be
ready for transmission relative the allocated time slot.

9. A device for reduction of delay of ATM traffic in a
communication network comprising a multitude of nodes (2-4),
according to claim 8, **characterized in** that these means comprise
at least one phase detector (26) and a phase delay unit (24)
which controls the phase for data in the downlink direction in
order to control the ATM cell generation in the circuit emulator
(11) so that a cell is packed at the same time as or just before
transmission in a time slot allocated for this purpose on the
uplink direction of the physical medium.

10. A device for reduction of delay of ATM traffic in a
communication network comprising a multitude of nodes (2-4),
according to claim 8, **characterized in** that these means comprise
a phase detector (26') and a control channel (30) from this for
transmission of phase information to, a PLL (21') connected to a
transmitter (22), for control of the ATM cells generated in the
transmitter (22) so that the phase when a cell is packed occurs
at the same time or just before transmission in a time slot
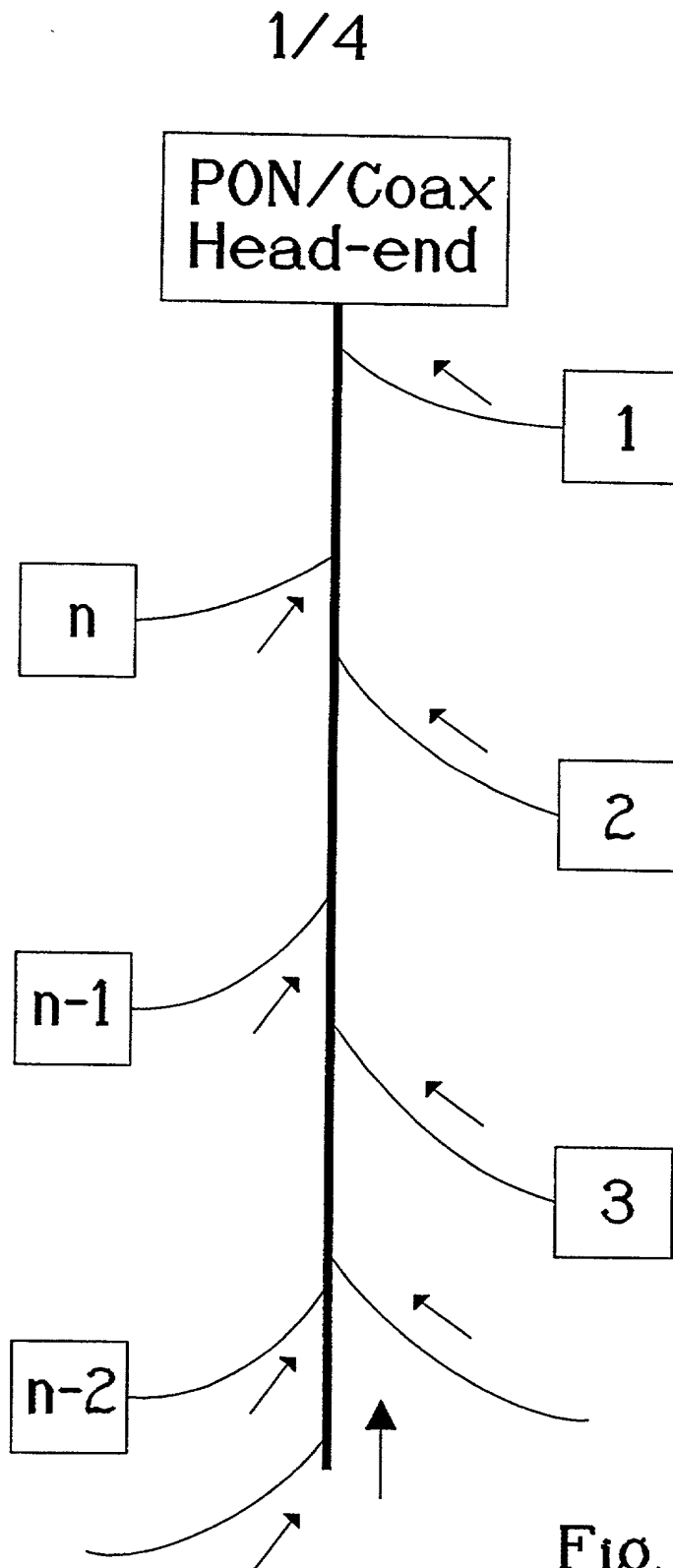allocated for this purpose on the physical medium.
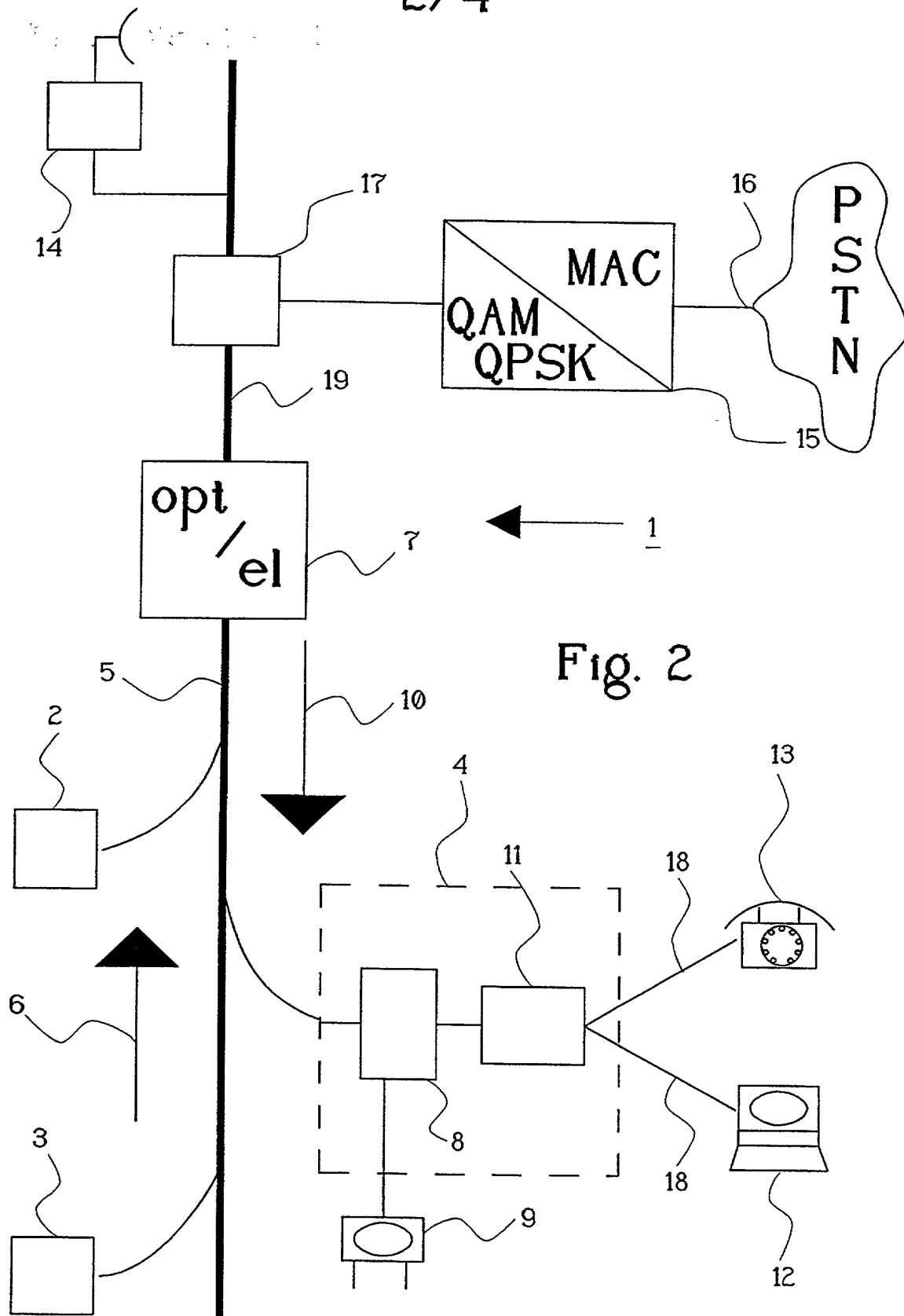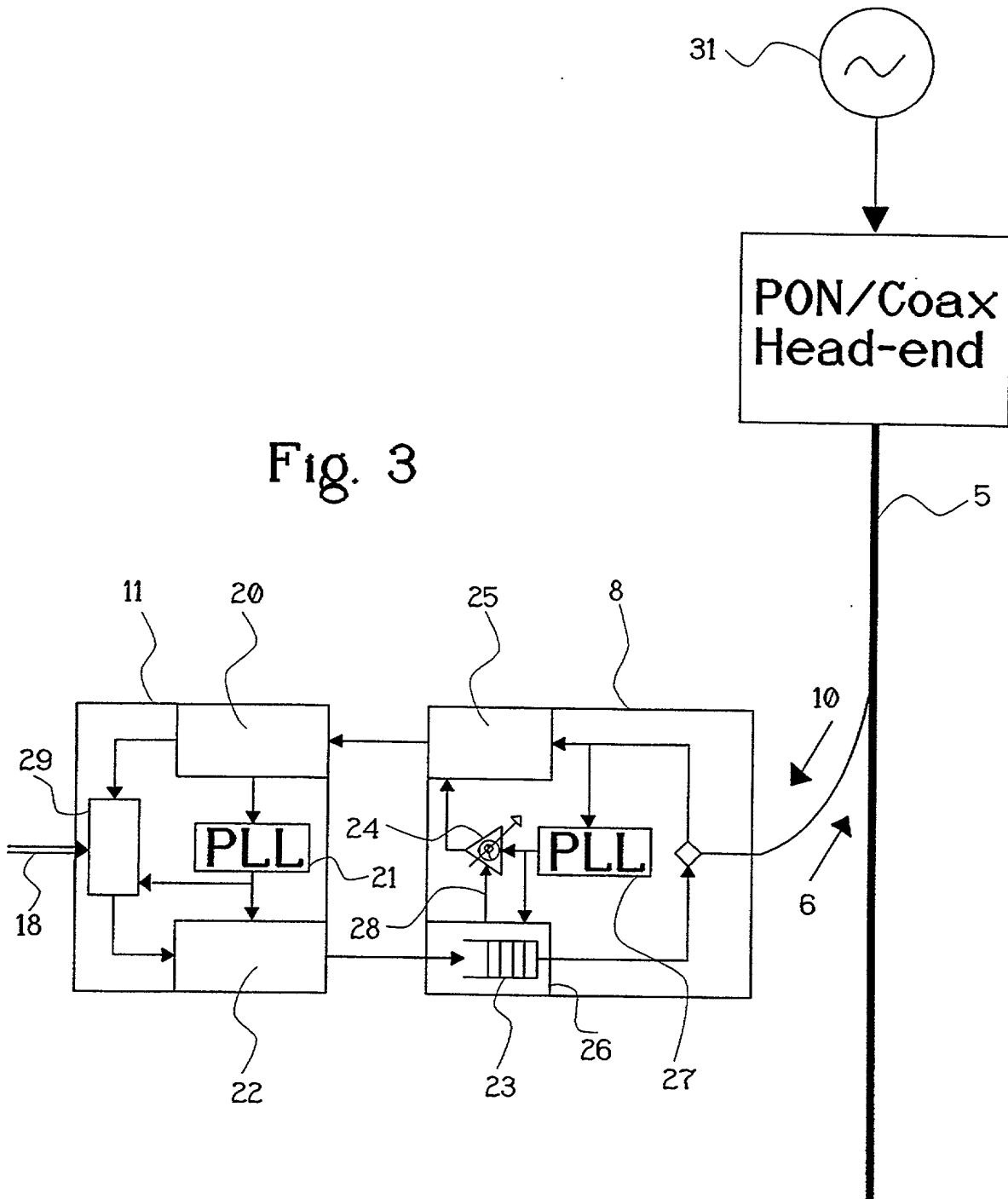
PON/Coax
Head-end

1

n

2

n-1

3

n-2

Fig. 1

Fig. 2

Fig. 3

Fig. 4

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (Includes Reference to Provisional and PCT International Applications)	Attorney's Docket No. 040060-108

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name;
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A METHOD AND A DEVICE FOR DELAY REDUCTION IN A COMMUNICATION NETWORK

the specification of which (check only one item below):

☐ is attached hereto.

☐ was filed as United States application

Number _____

on _____

and was amended

on _____ (if applicable).

☒ was filed as PCT international application

Number __PCT/SE98/02219_____

on __December 4, 1998_____

and was amended

on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 (a)-(e) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. §119:

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. §119	
Sweden	9704766-6	19 December 1997	X Yes	_ No
			_ Yes	_ No
			_ Yes	_ No
			_ Yes	_ No
			_ Yes	_ No

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

_____   _____
(Application Number)   (Filing Date)

_____   _____
(Application Number)   (Filing Date)

(1/00)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States applications(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose to the Office all information known to me to be material to the patentability as defined in Title 37, Code of Federal Regulations §1.56, which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. §120:

| U.S. APPLICATIONS | | STATUS (check one) | | |
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

| PCT APPLICATIONS DESIGNATING THE U.S. | | | | | |
PCT APPLICATION NO.	PCT FILING DATE	U.S. APPLICATION NUMBERS ASSIGNED (if any)			

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(1/00)

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONT'D) (Includes Reference to Provisional and PCT International Applications)	Attorney's Docket No. 040060-108

FULL NAME OF SOLE OR FIRST INVENTOR Peter LARSEN	SIGNATURE *Peter Larsen*	DATE *August 21, 2000*
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POST OFFICE ADDRESS		

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RESIDENCE		CITIZENSHIP
POST OFFICE ADDRESS		

(1/00)